

# 5E Lesson Plan

**Lesson Title:** The Oceans, Mountains and Climate

**Subject area / course / grade level:** Earth Science – Grades 5/6

**Introduction:** The purpose of this exercise is to illustrate the relationships between the temperature of ocean water, mountain ranges, and continental climate. The exercise is completed by study of a series of maps illustrating distribution of temperature, rainfall and dew points across the continental United States.

**Lesson Length:**

**Materials:** Temperature, precipitation and dew point maps available online. Recommended website: coolwx.com

**Lesson Overview:**

Students study and compare various ocean and North America maps to develop an understanding of the relationships between oceanic circulation patterns, sea-surface temperatures, land surface temperatures, and dew points. Students also study the relationships between precipitation amount and western North America mountain ranges.

**Tennessee Standards: Grade 5 – The Atmosphere:**

Grade Level Expectation: Analyze and predict how major landforms and bodies of water affect atmospheric conditions.

Checks for Understanding: 1) Compare the climates of coastal and inland areas at similar latitudes to demonstrate the ocean's impact on weather and climate. 2) Use land maps to demonstrate how mountain ranges affect weather and climate.

State Performance Indicators: Describe the effects of the oceans on weather and climate. 2) Explain how mountains affect weather and climate.

**Lesson objective(s):**

- 1) An understanding of the ocean's impact on the temperature, precipitation and dew points of coastal and inland areas at similar latitudes.
- 2) An understanding of how mountain ranges affect precipitation.

**ENGAGEMENT**

- Describe how the teacher will capture students' interest.

Teachers may want to discuss the importance of climate to students' daily activities (clothing, outdoor activities). There also should be a discussion of the difference between weather and climate.

- What kind of questions should the students ask themselves after the engagement?

Students should ask themselves how climate is important to their lives every day? They should also ask how their lives would be different if either the climate changed, or they moved to a new place with a different climate.

## EXPLORATION

- Describe what hands-on/minds-on activities students will be doing.  
Examining various types of maps to learn the relationships between ocean water circulation and temperatures and regional land surface temperatures, temperature changes, and dew points. Students also will compare maps of mountain ranges and precipitation amounts to learn the effects which mountain ranges have on regional rainfall.
- List “big idea” conceptual questions the teacher will use to encourage and/or focus students’ exploration  
What is the ‘connection’ between the oceans and our climate?  
Is that connection the same everywhere?  
Other than changes in the seasons, what factor most influences daily temperature and daily temperature change in the United States?

## EXPLANATION

- Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination?  
Teachers will need to discuss large-scale basic oceanic circulation patterns (gyres), and prevailing wind directions in North America before students attempt this exercise.
- List higher order thinking questions which teachers will use to solicit *student* explanations and help them to justify their explanations.  
See attached.

## ELABORATION

- Describe how students will develop a more sophisticated understanding of the concept.  
The exercise is intended to help students understand factors which impact regional climate, as opposed to local weather.
- What vocabulary will be introduced and how will it connect to students’ observations?  
gyre, dew point, leeward, windward

## EVALUATION

- How will students demonstrate that they have achieved the lesson objective?  
See attached

Important background information for this lesson may be found at the following web sites:

The Oceans:

<http://mtweb.mtsu.edu/cribb/100oceans.html>

<http://mtweb.mtsu.edu/cribb/1030ceans.ppt>

The Atmosphere:

<http://mtweb.mtsu.edu/cribb/1030atmosphere.ppt>

<http://mtweb.mtsu.edu/cribb/1030atmosphere.html>

# The Oceans, Mountains, and Climate

Overview: The purpose of this exercise is to illustrate the relationships between the temperature of ocean water, mountain ranges, and continental climate. The exercise is completed by study of a series of maps illustrating distribution of temperature, rainfall and dew points across the continental United States.

Expected Outcomes:

- 1) An understanding of the ocean's impact on the temperature, precipitation and dew points of coastal and inland areas at similar latitudes.
- 2) An understanding of how mountain ranges affect precipitation.

Instructions: This exercise requires examination and interpretation of the following maps:

- 1) Oceanic Circulation
- 2) Buoy and Ship Sea Surface Temperatures
- 3) North America Surface Temperatures
- 4) United States Temperatures
- 5) United States 3-hour Temperature Change
- 6) United States 24-hour Temperature Change
- 7) United States Dewpoint
- 8) North America Dewpoint
- 9) North America Mountain Ranges
- 10) United States Annual Average Precipitation

## Oceanic Circulation Map

1. What are the names of the oceanic circulation features which border North America in the Pacific and Atlantic Oceans?

2. Along the east coast of North America, \_\_\_\_\_ water circulates along the coast. Along the west coast of North America, \_\_\_\_\_ water circulates along the coast.

### Buoy and Ship Sea Surface Temperatures

1. At what latitudes are sea surface temperatures warmest? Equatorial or polar?
2. At what latitudes are sea surface temperatures coldest? Equatorial or Polar?
3. Compare sea surface temperatures just off the west and east coast of the United States.

Where is the warmest (colored red and yellow) water?

Where is the coldest (colored blue) water?

Where is most of the cool (colored green) water?

4. Compare this map to the Oceanic Circulation map. Explain why the water off the southeast coast of the United States is mostly warm, the water off the northeast coast of the United States mostly cold, and the water off the west coast of the United States mostly cool.

### North American Surface Temperature Map

1. Where are temperatures warmest?
2. Where are temperatures coldest?
3. Compare this map to the Oceanic Circulation and Sea Surface Temperature maps. Do you see a correlation between sea surface temperatures and coastal temperatures? If so, what is the relationship between the two?

### United States Temperature Map

Washington State and Oregon lie at approximately the same latitude as the New England States. Compare the surface temperatures in these two regions of the country.

1. Where are the surface temperatures warmer?
2. Where are the surface temperatures colder?
3. Compare this map to the Sea Surface Temperature map. Is there a correlation between the sea surface temperatures off the coast of Oregon and Washington State and the land surface temperatures? If, describe it.
4. Make the same comparison for sea surface temperatures and land temperatures in the New England states. Is there a correlation between the two? If so, describe it.

### United States 3-hour Temperature Change Map

Compare the 3 hour change in temperature along the west coast, east coast, and inland areas.

1. Where do temperatures change the most, inland regions or coastal regions?
2. Where do temperatures change the least, inland regions or coast regions?
3. Why is there a difference in the 3-hour temperature change between the two regions?

### United States 24-Hr Temperature Change Map

Compare the 24-hour temperature change in Washington State and Oregon to that in the New England States.

1. Where do temperatures change the most over 24 hours?
2. Where do temperatures change the least over 24 hours?
3. Why is there a difference in 24 hour temperature change between the two regions?

4. Over a 24-hour period, the greatest amount of temperature change in the United States occurs in the mid-continent region. Why is the 24-hour temperature change in the mid-continent greater than the 24-hour temperature change along either the West Coast, Gulf Coast or East Coast?

#### United States Dewpoint and North America Surface Dewpoint Maps

Compare the dewpoints along the West coast, Gulf coast, and East coast.

1. Along which coastal regions are dewpoints the highest?
2. Along which coastal regions are dewpoints the lowest?
3. Is there a relationship between dewpoints and sea surface temperatures? If so, describe the relationships.

#### North America Mountain Range and Annual Average Precipitation Maps

1. In western North America, where is the amount of precipitation highest?
2. In western North America, where is the amount of precipitation lowest?

Locate the Cascade Range and the Sierra Nevada Range on the map of mountain ranges, then examine the amount of precipitation which falls along the west and east sides of these ranges?

3. Which side receives a greater amount of precipitation?
4. Which side receives a lower amount of precipitation?
5. Explain why one side of western North America mountain ranges would receive a different amount of precipitation than the other side.

Summary:

Describe the relationships between oceanic circulation patterns and sea surface temperatures along the East and West Coasts of the United States.

Describe the relationships between East and West Coast land surface and sea surface temperatures.

Explain why short-term temperature changes are greater along coastal regions than within inland regions.



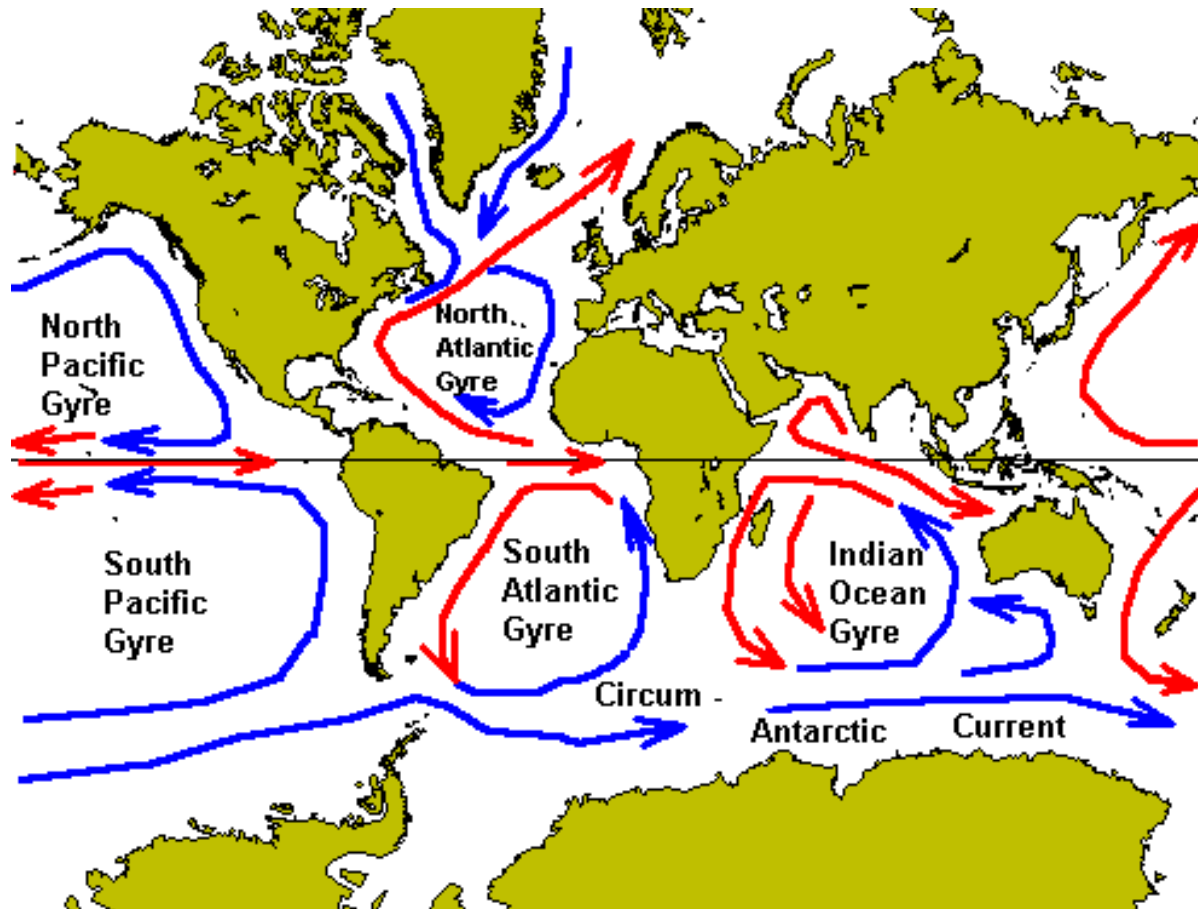
.  
Explain why dew points are greater along the West Coast and Gulf Coast than along the Northeast Coast.

Explain why the amount of precipitation which falls on the west side of mountain ranges such as The Cascades and Sierra Nevada is greater than the amount of rainfall which falls on the west side.

# Oceanic Circulation

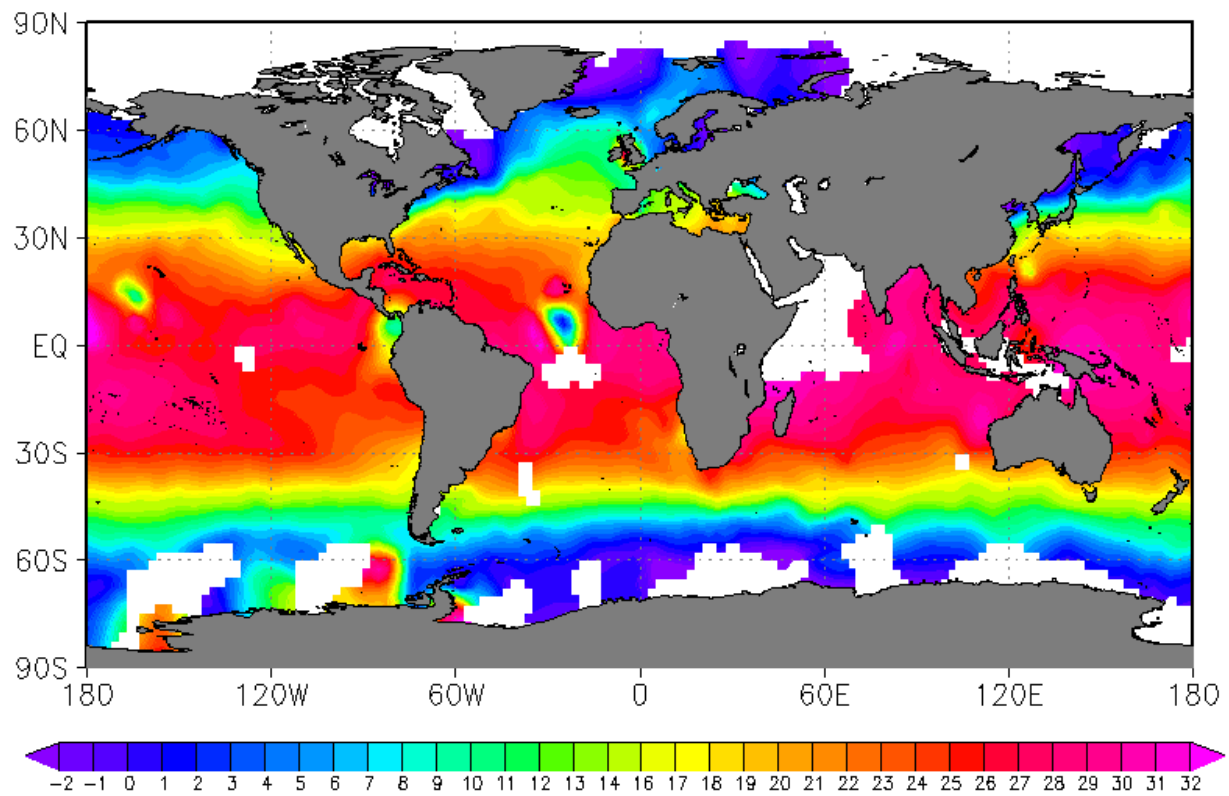
Red = Warm

Blue = Cold



<http://coolwx.com/buoydata>

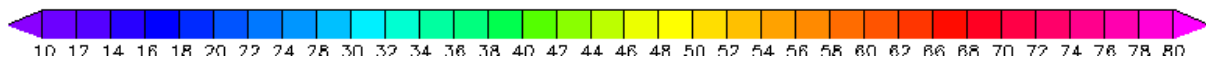
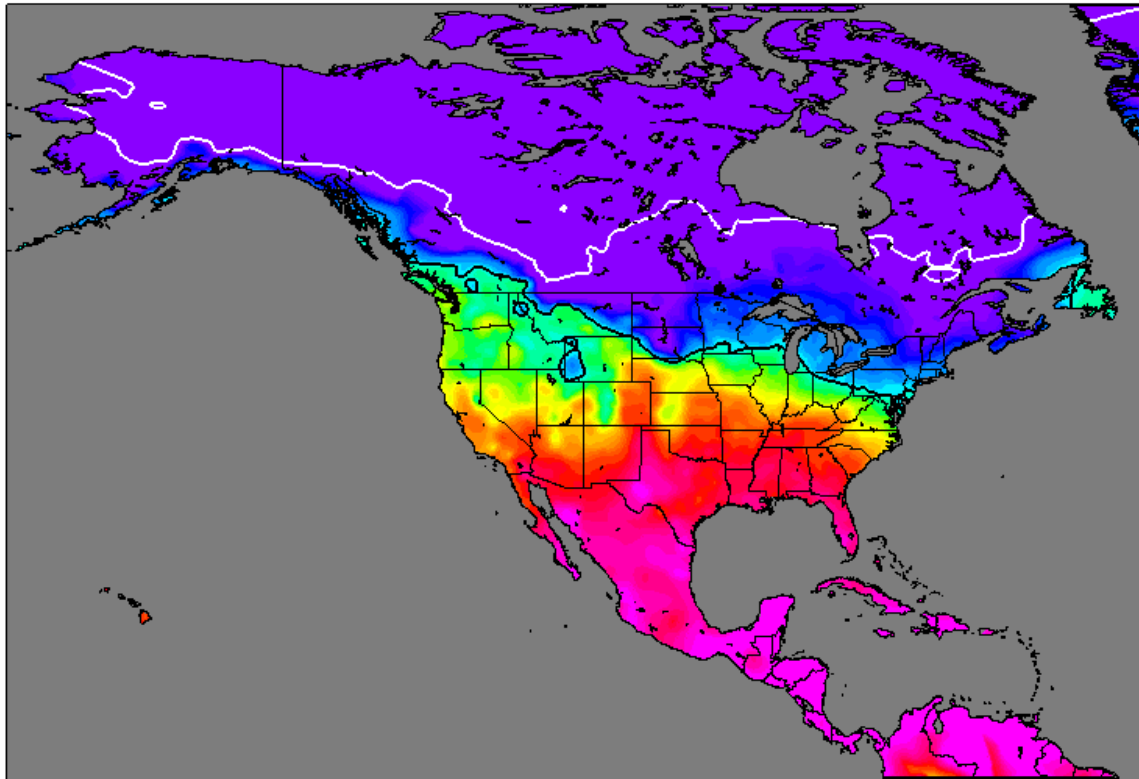
# Buoy & Ship Sea Surface Temperature (°C) Analysis at 12Z / MAR 03, 2011



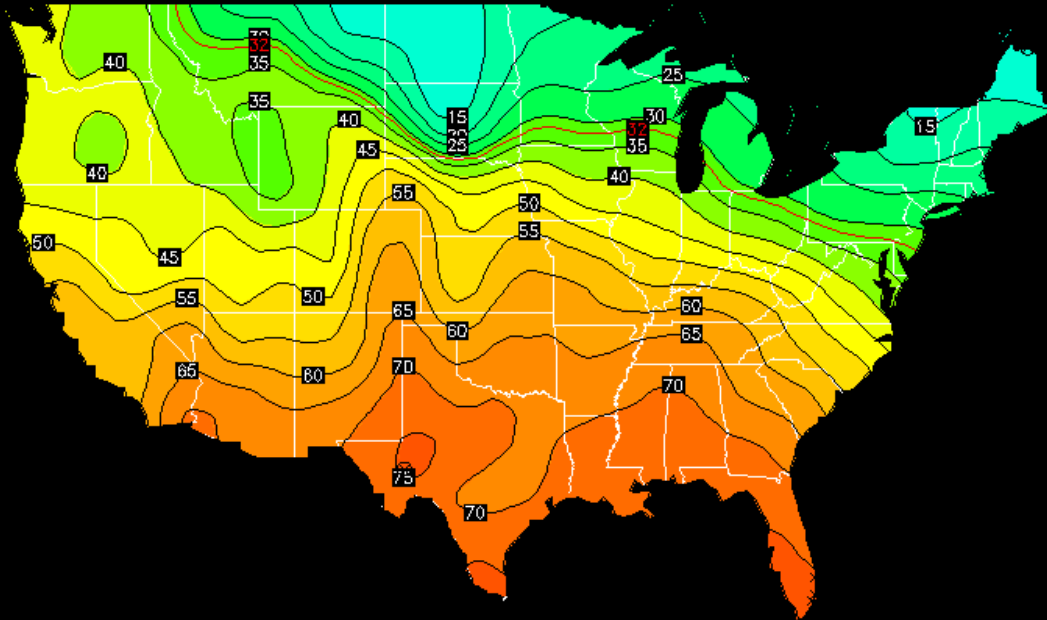
Contoured every 2 degrees.

<http://coolwx.com/analysis>

Surface Temperature (°F) at 18Z/MAR 03, 2011



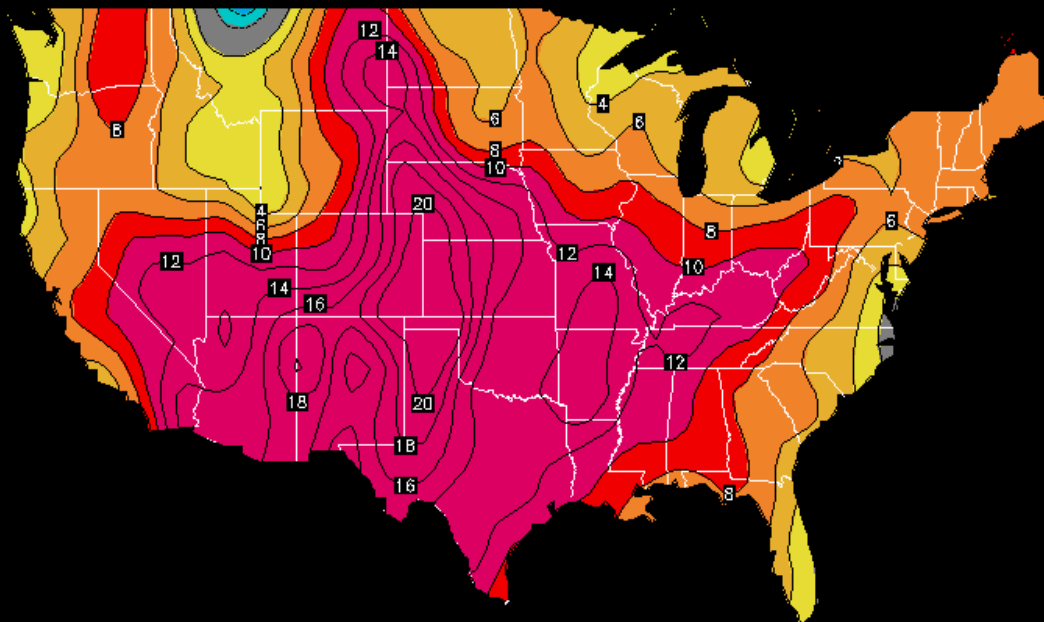
Temperature (°F) at 18Z/MAR 03 2011



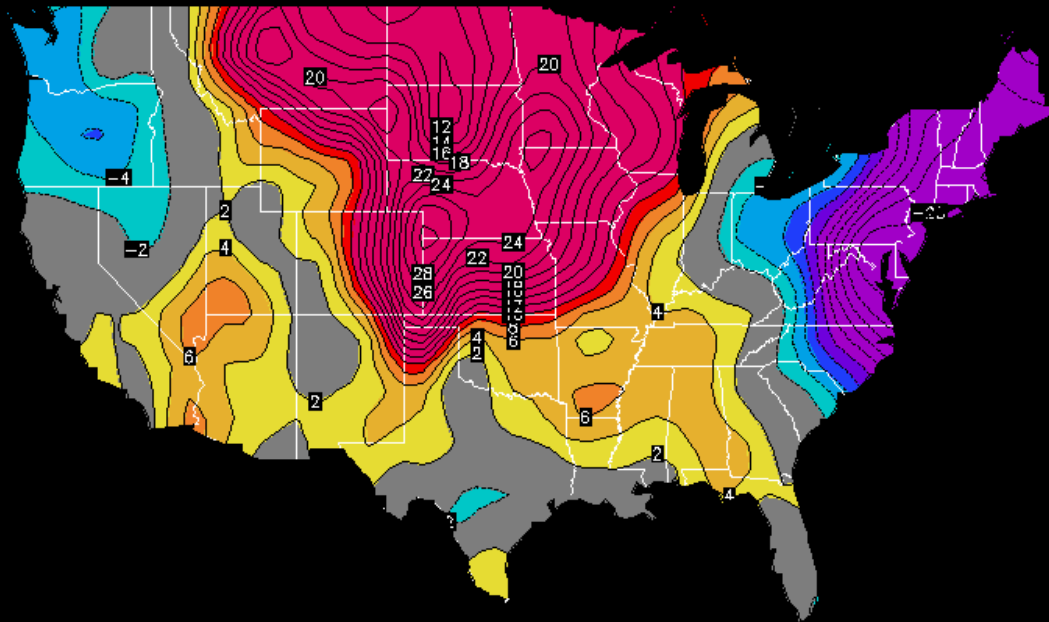
X plots minimum and maximum reported values during past 12 hrs. Circled X is current.

<http://coolwx.com/usstats>

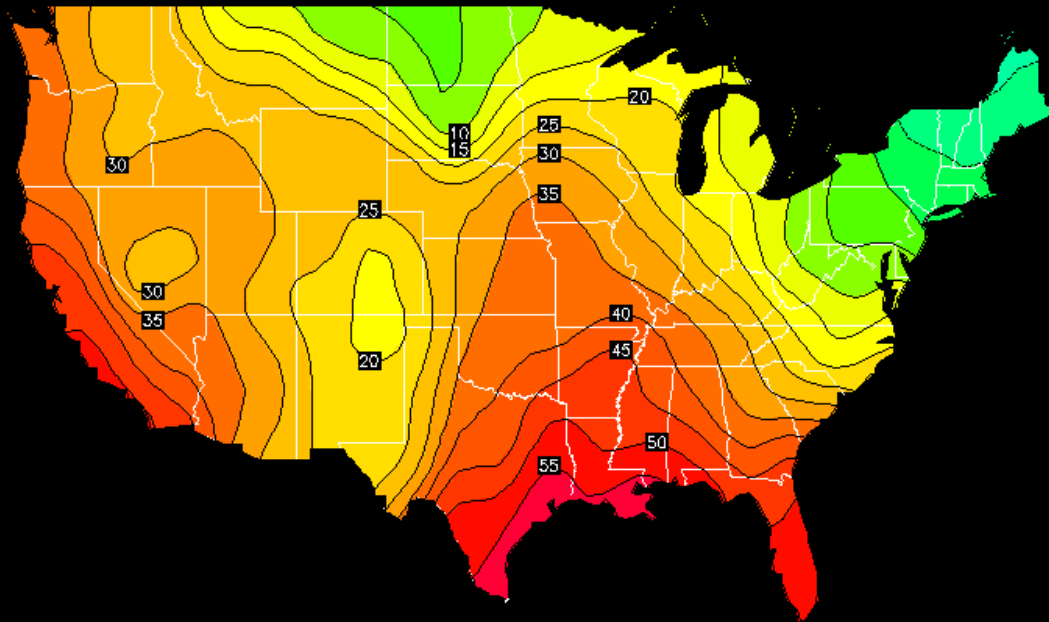
3-Hr Temp Change (°F) ending 18Z/MAR 03 2011



24-Hr Temp Change (°F) ending 18Z/MAR 03 2011



Dewpoint (°F) at 18Z/MAR 03 2011



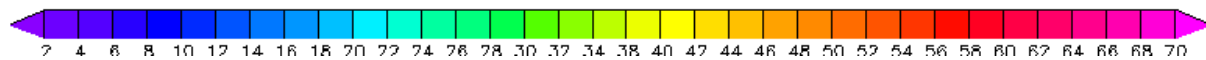
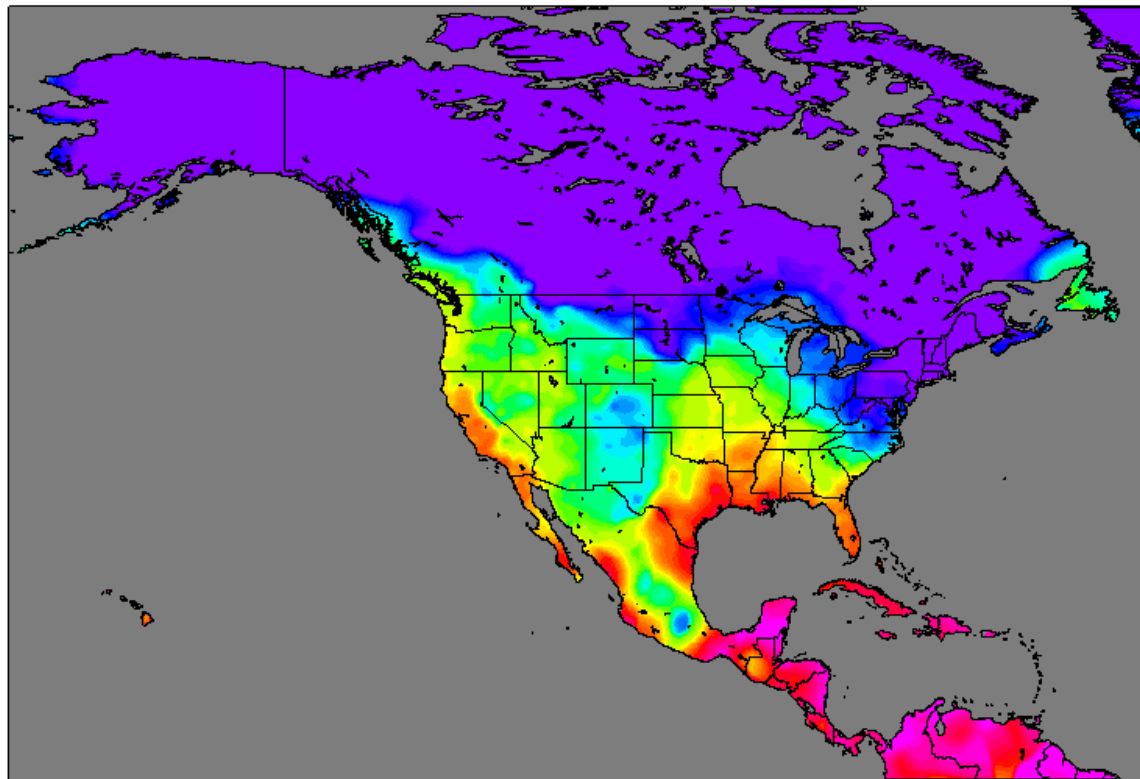
<http://coolwx.com/usstats>



Contoured every 2 degrees.

<http://coolwx.com/analysis>

Surface Dewpoint (°F) at 18Z/MAR 03, 2011



# Annual Average Precipitation

United States of America

